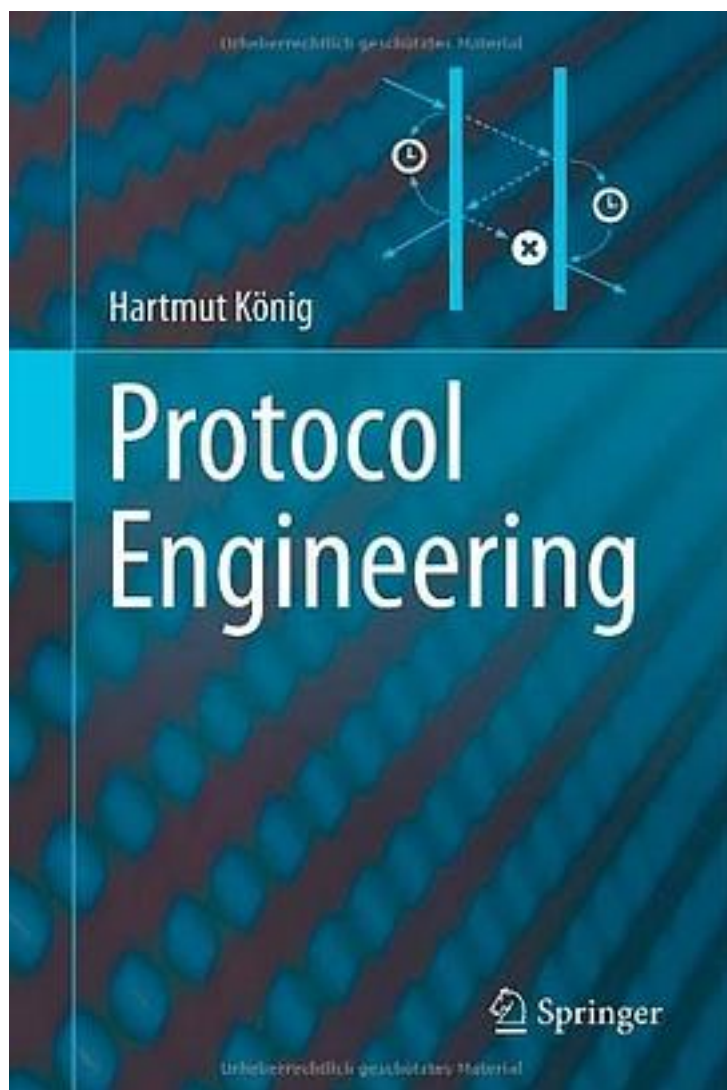# Protocol Engineering

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Communication protocols form the operational basis of computer networks and tele communication systems. They are behavior conventions that describe how com munication systems inter act with each other, defining the temporal order of the interactions and the formats of the data units exchanged - essentially they determine the efficiency and reliability of computer networks. Protocol Engineering is an important discipline covering the design, validation, and implementation of communication protocols. Part I of this book is devoted to the fundamentals of communication protocols, describing their working principles and implicitly also those of computer networks. The author introduces the concepts of service, protocol, layer, and layered architecture, and introduces the main elements required in the description of protocols using a model language. He then presents the most important protocol functions. Part II deals with the description of communication proto cols, offering an overview of the various formal methods, the essence of Protocol Engineering. The author introduces the fundamental description methods, such as finite state machines, Petri nets, process calculi, and temporal logics, that are in part used as semantic models for formal description techniques. He then introduces one represen tative technique for each of the main description approaches, among others SDL and LOTOS, and surveys the use of UML for describing protocols. Part III covers the protocol life cycle and the most important development stages, presenting the reader with approaches for systematic protocol design, with various verification methods, with the main implementation techniques, and with strategies for their testing, in particular with conformance and interoperability tests, and the test description language TTCN. The author uses the simple data transfer example protocol XDT (eXample Data Transfer) throughout the book as a reference protocol to exemplify the various description techniques and to demonstrate important validation and implementation approaches. The book is an introduction to communication protocols and their development for undergraduate and graduate students of computer science and communication technology, and it is also a suitable reference for engineers and programmers. Most chapters contain exercises, and the author's accompanying website provides further online material including a complete formal description of the XDT protocol and an animated simulation visualizing its behavior.

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